



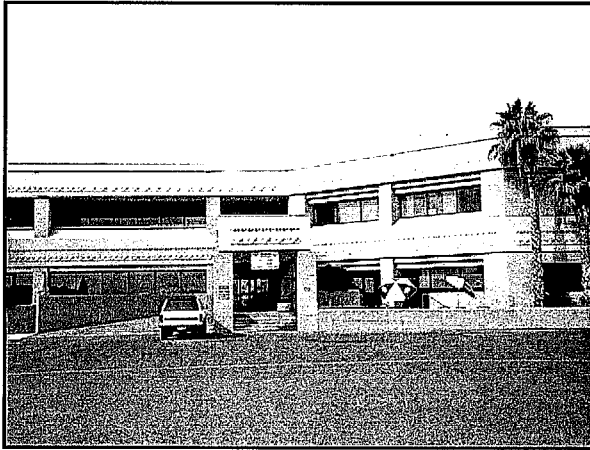
GLEND~~A~~LE

MUNICIPAL AIRPORT

Chapter Two

AVIATION DEMAND FORECASTS

AVIATION DEMAND FORECASTS



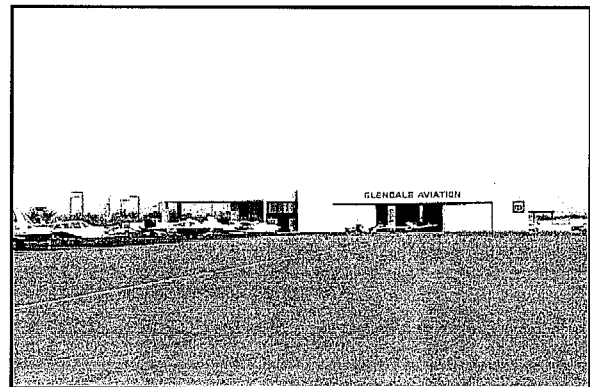
Facility planning must begin with a definition of the demand that may reasonably be expected to occur at the facility over a specific period of time. In airport master planning, this involves forecasts of aviation activity indicators over a twenty-year planning period. In this master plan, forecasts of based aircraft, based aircraft fleet mix, and annual aircraft operations will serve as the basis for facility planning.

It is virtually impossible to predict with certainty year-to-year fluctuations of activity when looking twenty years into the future. Because aviation activity can be affected by many influences at the local, regional, and national level, it is important to remember that forecasts are to serve only as guidelines and planning must remain flexible enough to respond to unforeseen facility needs.

The following forecast analysis examines recent developments, historical information, and current aviation trends to provide an updated set of based aircraft and operational projections. The intent is to permit the City of Glendale to make the planning adjustments necessary to ensure that the facility meets projected demands in an efficient and cost effective manner.

NATIONAL AVIATION TRENDS

Each year, the Federal Aviation Administration (FAA) publishes its national aviation forecast. Included in this publication are forecasts for air carriers, air taxi/commuters, general aviation, and military activity. The forecasts are prepared to meet budget and planning needs of the constituent units of the FAA and to provide



information that can be used by state and local authorities, the aviation industry, and the general public. The current edition is *FAA Aviation Forecasts-Fiscal Years 1996-2007*. The forecasts use the economic performance of the United States as an indicator of future aviation industry growth in the United States. Similar economic analyses are applied to the outlook for aviation growth in international markets.

For the U.S. aviation industry, the outlook for the next twelve years is for moderate to strong economic growth, moderately increasing fuel prices, and moderate inflation. Based on these assumptions, aviation activity by fiscal year 2007 is forecast to increase by 19.5 percent at towered airports and 26.8 percent at air route traffic control centers. The general aviation active fleet is projected to decline for the next few years then begin to rebound for a net increase of 4.9 percent. General aviation hours flown are forecast to increase by 9.9 percent during the same period.

NATIONAL GENERAL AVIATION TRENDS

The general aviation industry is an important contributor to the nation's economy. General aviation includes the production and sale of aircraft, avionics and other equipment, along with the provision of support services such as flight schools, fixed base operators, finance and insurance. In general, general aviation has been in a state of decline for more than a decade. A number of events have factored into this

extended decline in the general aviation industry. These have included the deregulation of the airline industry, increases in airspace restrictions for Visual Flight Rule (VFR) only aircraft, reductions in leisure time, and shifts in personal preferences for goods, services, and leisure time. The overriding factor, however, has been the increased cost in owning and operating a general aviation aircraft.

There are a number of reasons, however, to maintain a favorable outlook of the general aviation industry. One of the primary reasons is the passage of the General Aviation Revitalization Act of 1994. This legislation limits the liability on general aviation aircraft to 18 years from the date of manufacture. This has sparked an interest in aircraft manufacturers to renew the manufacturing of general aviation aircraft due to the reduction in product liability brought about by this legislation. The high cost of product liability insurance was a major factor in the decision to slow (or in some cases) discontinue general aviation aircraft production.

Since the enactment of this legislation in August 1994, Cessna aircraft has committed to resume the production of selected single engine piston aircraft and Piper has announced plans to increase its production level. The first new Cessna piston-engine aircraft built in more than a decade rolled off the Cessna production lines in Independence, Kansas in November, 1996. General aviation aircraft shipments were up 12.9 percent in 1995 reversing a six-year decline in aircraft shipments. Most notable about this

increase was that it occurred across all aircraft types. In addition, the amateur-built aircraft market has shown steady growth over the past several years.

Other reasons for a more favorable long range outlook for general aviation is a growing realization that the industry must "reinvent" itself. As a result, several federal, manufacturer, and industry programs have been initiated. Among these is the FAA's recent streamlining of the small aircraft certification process to include a new entry-level aircraft (Primary Category Rule) that could encourage the production of small, affordable aircraft.

The General Aviation Action Plan Coalition, formed by eleven general aviation organizations, supports the implementation of the FAA's General Aviation Action Plan. This action plan has goals to seek to provide for regulatory relief and reduced user costs, improved delivery of services through reduced layers of management and more communication, elimination of unneeded programs and processes, and encouragement of product innovation and competitiveness.

Manufacturer and industry programs include the "No Plane No Gain" program promoted jointly by the General Aviation Manufacturers and The National Business Aircraft Association. This program is designed to promote the use of general aviation aircraft as an essential tool of business. Other programs are intended to promote growth in the number of new pilot starts and general flying and intro-

duce people to general aviation. These include the Aircraft Owners and Pilots Association "Project Pilot"; the National Air Transportation Association's "Learn to Fly" program, and the Experimental Aircraft Association's "Young Eagles" program.

The most notable trend in general aviation is the continued strong use of general aviation aircraft for business and corporate uses. In 1994, the number of hours flown by the combined use categories of business and corporate flying represented 23.3 percent of total general aviation activity. In 1990, the number of hours flown by the combined use categories of business and corporate flying represented 21.8 percent of total general aviation activity.

As a result of continued strong use of general aviation aircraft for business and corporate uses, the character of the general aviation fleet has continued to change from a fleet consisting mostly of small piston powered aircraft to a fleet made up of more sophisticated turbine powered aircraft. Reflecting the increasing convenience of general aviation flying to business and their push for more sophisticated, turbine powered aircraft, FAA long-term projections show this segment of general aviation growing more rapidly than all others. FAA forecasts project the active turbine-powered fleet growing 1.5 percent annually through the year 2007. This includes the number of turboprop aircraft growing from 4,207 in 1995 to 5,000 in 2007 and the number of turbojet aircraft increasing from 4,073 in 1995 to 4,900 in 2007.

A trend in the type of general aviation operations at FAA towered airports and the number of general aviation aircraft handled at FAA enroute traffic control has also emerged. General aviation operations at both locations have registered increases in the past two years reflecting an increased use of technologically advanced, sophisticated aircraft in adverse weather conditions. General aviation instrument operations at towered airports were up 1.9 percent in 1994 and 0.6 percent in 1995. The number of general aviation aircraft handled at en route centers was up 2.7 percent in 1994 and 3.9 percent in 1995.

Overall, the active general aviation aircraft fleet is expected to continue to decline for the short-term, followed by slow growth. The aging piston-engine portion of the active aircraft fleet is the primary reason for the short term decline in active aircraft. The average age of the active aircraft fleet is 27 years with piston aircraft accounting for most of the aging aircraft. Piston aircraft are anticipated to have a net increase of 3,300 units in the active fleet by 2007. **Exhibit 2A** depicts the FAA forecast for active general aviation aircraft in the United States.

AIRPORT SERVICE AREA

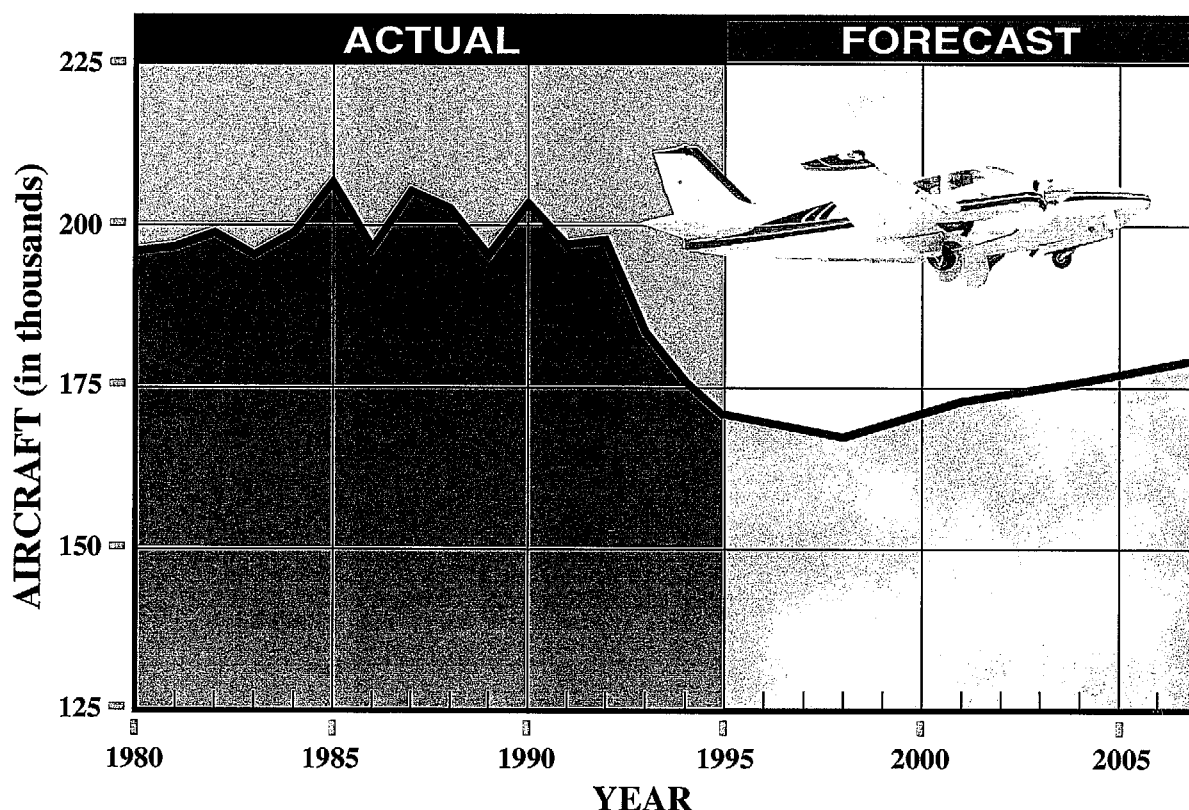
The initial step in determining aviation demand for an airport is to define its generalized service area for the various segments of aviation the airport can accommodate. The airport service area is determined primarily by evaluating the location of competing airports, their capabilities and services, and their relative attraction and convenience.

With this information, a determination can be made as to how much aviation demand would likely be accommodated by a specific airport. The airport service area is an area where there is a potential market for airport services. Access to general aviation airports, commercial air service, and transportation networks enter into the equation that determines the size of a service area, as well the quality of aviation facilities, distance, and other subjective criteria.

In determining the aviation demand for an airport it is necessary to identify the role of that airport. The primary role of the Glendale Municipal Airport is to serve the needs of general aviation. General aviation is a term used to describe a diverse range of aviation activities which includes all segments of the aviation industry except commercial air carriers and military. General aviation is the largest component of the national aviation system and includes activities ranging from pilot training, to recreational flying, to the use of sophisticated turboprop and turbojet aircraft for business and corporate uses.

A review of aircraft ownership for based aircraft at Glendale Municipal Airport was made to determine the existing service area for based aircraft demand. Using based aircraft records maintained by the City of Glendale and Glendale Airport Hangars it was determined that most based aircraft owners maintain residences in the western Phoenix metropolitan area with the majority of these based aircraft being owned by residents of the cities of Glendale, Peoria, Sun City, Tolleson, Litchfield Park, and El Mirage. A small portion

ACTIVE GENERAL AVIATION AIRCRAFT



U.S. ACTIVE GENERAL AVIATION AIRCRAFT (in thousands)

As of January 1	FIXED WING				ROTORCRAFT				
	PISTON		TURBINE		Piston	Turbine	Experimental	Other	Total
	Single Engine	Multi- Engine	Turboprop	Turbojet					
1995	123.3	15.6	4.2	4.1	1.4	3.0	12.9	6.2	170.6
1998	119.0	15.1	4.4	4.3	1.3	3.0	13.5	6.7	167.3
2001	122.6	15.5	4.6	4.5	1.2	3.0	14.1	7.0	172.5
2004	124.5	15.6	4.8	4.7	1.1	3.0	14.6	7.4	175.7
2007	126.4	15.8	5.0	4.9	1.1	3.0	15.0	7.7	178.9

Source: FAA Aviation Forecasts, Fiscal Years 1996-2007.

Notes: Detail may not add to total because of independent rounding. An active aircraft must have a current registration and it must have been flown at least one hour during the previous calendar year.



(approximately 4.5 percent) of the based aircraft owners base aircraft at Glendale Municipal Airport even though another general aviation airport is located closer to their residence. Approximately eight percent of based aircraft owners listed addresses in other portions of the state or outside of Arizona.

For the Glendale Municipal Airport, the generalized service area is limited by the nine public use airports in the Phoenix metropolitan area providing competing levels of service to general aviation. These public-use airports in the Phoenix metropolitan area were previously described in Chapter One. Glendale Municipal Airport, Phoenix-Deer Valley Airport, Buckeye Municipal Airport, and Phoenix-Goodyear are the primary airports serving general aviation in the western portion of the Phoenix metropolitan area. Phoenix-Sky Harbor International Airport (located centrally in the Phoenix Metropolitan area) also serves general aviation aircraft. The remaining general aviation airports are located on the east and southeast sides of the metropolitan area.

As mentioned earlier, Glendale Municipal Airport draws from a number of surrounding communities which are without an airport. The airport's draw from communities to the north is limited by Phoenix-Deer Valley Airport. Phoenix-Goodyear Airport and Buckeye Municipal Airport limit the service area of Glendale Municipal Airport to the west and southwest. Residents located east of Glendale can choose between Glendale and the Phoenix-Deer Valley Airport.

The growth of the Phoenix metropolitan area, including the City of Glendale, has been strong with little indication that it will significantly slow in the future. Urban development in the western portion of the Phoenix metropolitan area is likely to continue as well. Urban growth in the western portion of the Phoenix Metropolitan Area will tend to increase user demand at Glendale Municipal Airport as aircraft owners generally elect to base their aircraft close to their residences. The forecast analyses conducted in the following sections will take into consideration this expected regional growth and the other nearby airports which share a portion of the Glendale Municipal Airport service area.

As in any business enterprise, the more attractive the facility is in services and capabilities, the more competitive it will be in the market. As the level of attractiveness expands, so will the service area. If an airport's attractiveness increases in relation to nearby airports, so will the size of the service area. If facilities are adequate and rates and fees are competitive at Glendale Municipal Airport, some level of general aviation activity might be attracted to the airport from surrounding areas.

SOCIOECONOMIC PROJECTIONS

Local population and employment forecasts provide an indication of the potential for sustaining growth in aviation activity over the planning period. **Table 2A** summarizes

historical and forecast resident household population and total employment for the City of Glendale

Metropolitan Planning Area (MPA) and Maricopa County.

TABLE 2A Forecast Resident Population in Households and Total Employment City of Glendale MPA, Maricopa County				
	City of Glendale MPA		Maricopa County	
Year	Population	Employment	Population	Employment
Historical				
1990	159,068	50,430	2,130,400	975,037
1995	188,610	62,802	2,528,700	1,264,800
Forecast				
2000	216,843	76,289	2,954,150	1,482,983
2005	237,178	87,459	3,329,550	1,678,093
2010	260,561	98,754	3,709,575	1,877,045
2015	288,225	106,982	4,101,775	2,042,684
2020	305,164	115,090	4,516,100	2,212,889
Source: <i>Update of the Population and Socioeconomic Database for Maricopa County, Arizona;</i> Maricopa Association of Governments; March, 1993 (1990); Maricopa Association of Governments; July, 1997 (1995-2020)				

Between 1990 and 1995, the resident household population and total employment in both the Glendale MPA and Maricopa County has grown steadily. The resident household population in the Glendale MPA grew by 26,821, an average annual rate of 3.1 percent. Total employment grew at an average annual rate of 4.4 percent, increasing by over 12,000. The Glendale MPA resident household population is projected by the Maricopa Association of Governments (MAG) to grow to 314,303 by the year 2020; at an average annual growth rate of 2.1 percent. Employment is expected to increase to 155,088 during the same

period (an average annual growth rate of 2.4 percent).

Maricopa County resident household population grew by 387,711 between 1990 and 1995, an average annual rate of 3.5 percent. Total Maricopa County employment grew by 289,763 over the same period, averaging an annual growth rate of 5.3 percent. The Maricopa County resident household population is projected grow at an average annual rate of 2.3 percent to 4,434,075 by the year 2020. Total employment is projected to grow at a similar rate to population and reach 2,258,047 by the year 2020.

GENERAL AVIATION FORECASTS

To determine the types and sizes of facilities that should be planned to accommodate general aviation activity, certain elements of this activity must be forecast. Indicators of general aviation demand include: based aircraft, the based aircraft fleet mix, annual operations, and peak activity. The remainder of this chapter will examine historical trends with regard to these areas of general aviation and project future demand for these segments of general aviation activity at the airport.

BASED AIRCRAFT

The number of based aircraft is the most basic indicator of general aviation demand at an airport. By first developing a forecast of based aircraft, the growth of aviation activities at the airport can be projected. Historical information regarding both based aircraft at the airport and Maricopa County registered aircraft was obtained from the *Regional Aviation System Plan (RASP) Implementation Study* (1996) prepared for the Maricopa County Association of Governments (MAG), the 1995 *State Aviation Systems Needs Study (SANS)*, and from the Arizona Department of Transportation-Aeronautics Division (ADOT).

As indicated on **Table 2B**, 1992-1996 registered based aircraft for Maricopa County fall well below the previous years. The lower numbers reported by ADOT demonstrate that many aircraft registered in Maricopa County are not actively based there. For this reason,

Arizona Department of Transportation (ADOT) decided to assign aircraft to airports based upon "N" numbers from state aircraft registrations.

The decreasing trend can also be attributed to the method utilized in reporting the data. Aircraft registrations presented in the *SANS* were researched from the FAA's *Census of U.S. Civil Aircraft*. The census publication lists all aircraft registrations reported within the county. As is often the case, aircraft owners may elect to register their aircraft within a county while not actually basing their aircraft within the same county.

Forecasts of registered aircraft for Maricopa County presented in **Table 2B** indicate a return to previous levels. By 2015, MAG projects that registered aircraft for the county will reach 3,832.

Historical based aircraft figures for Glendale Municipal Airport are also presented in **Table 2B**. The December 1996 total of 188 based aircraft as provided by the Arizona Department of Transportation, Aeronautics Division (ADOT), and verified during the inventory of existing conditions, represents the highest based aircraft total since 1990. Based aircraft totals declined annually between 1990 and 1993, consistent with national trends. While based aircraft totals have recently recovered and increased, they are still below the peak based aircraft total of 209 in 1987, one year after the airport opened.

A number of forecasting techniques have been utilized to analyze future

TABLE 2B
Historical and Forecast Based Aircraft
Glendale Municipal Airport

Year	Maricopa County Registered Aircraft ¹	Glendale Municipal Airport Based Aircraft ²		Percent of Maricopa County Registered Aircraft Based at Glendale
<i>Historical</i>				
1986	3,645	205		5.62%
1987	3,555	209		5.88%
1988	3,415	197		5.77%
1989	3,261	167		5.12%
1990	3,157	202		6.39%
1991	3,407	167		4.90%
1992	2,840	160		5.63%
1993	2,664	143		5.36%
1994	2,404	178		7.40%
1995	2,662	184		6.91%
1996	2,801	188		6.71%
<i>Forecast</i>	<i>MAG RASP²</i>	<i>MAG RASP²</i>		
2000	3,228	256	7.93%	
2005	3,404	288	8.46%	
2010*	3,619	325	8.98%	
2015	3,832	362	9.44%	
2020*	4,057	403	9.93%	
¹ Years 1983-1991 reported in 1995 State Aviation Needs Study; Years 1992-1996 Arizona DOT, Aeronautics Division				
² ADOT; MAG RASP				
* 2010 & 2020 forecasts for registered and based aircraft extrapolated from MAG RASP by Coffman Associates				

based aircraft demand at the airport. First, a series of trend line and regression analyses were performed. Trend line analyses pertain to projecting future activity based on previous trends. Regression analyses measure the correlation between two or more separate sets of historical data. The measure of the correlation between the sets of historical data is identified by the "correlation coefficient" (R value). The higher the R value, the more the separate sets of historical data are

related in some manner. The lower the R value, the greater the chance that the sets of historical data are not related. Normally, regression analyses with an R value below 0.95 are not used in projections as they do not provide a reasonable assurance of correlation between the sets of historical data.

Historical data related to regional and national general aviation aircraft and local and regional socioeconomic factors were utilized in the regression analyses

performed for this study. None of the regression analyses performed provided a R value near 0.95, consequently the regression analyses were not considered reliable enough to provide viable forecasts and were dropped from further consideration. The trend line analyses provided similar results. The decline in total based aircraft since 1986 and yearly fluctuations in based aircraft totals contributed to the poor results of both the trendline and regression analyses.

A market share analysis was conducted examining the existing and historical percentage of aircraft based at the Glendale Municipal Airport to registered aircraft in Maricopa County, FAA's Western Pacific Region, and U.S. Active Aircraft. Historical registered aircraft figures for Maricopa County were obtained from ADOT and the SANS. As indicated in **Table 2B**, the number of aircraft registered in Maricopa County between 1986 and 1996 decreased by 844 aircraft, from 3,645 in 1986 to 2,801 in 1996.

A market share comparison of based aircraft totals at Glendale Municipal Airport to registered aircraft in Maricopa County for the period from 1986 to 1996 is presented in **Table 2B**. Based aircraft at Glendale Municipal Airport have increased from 5.62 percent of the registered aircraft in Maricopa County in 1986 to 6.71 percent in 1996.

As mentioned earlier, MAG projects registered aircraft for Maricopa County to grow to 3,832 aircraft by 2015, which would equate to a 2.3 annual percent-

age growth rate from the 1996 figure of 2,801. The growth of registered aircraft compares favorably to forecast household population in Maricopa County which is also expected to grow at an average annual rate of 2.3 percent.

Based aircraft projections developed for the 1993 *MAG RASP* study for the Glendale Municipal Airport were also examined. This study projects based aircraft at Glendale Municipal Airport to increase to a total of 362 by 2015. This would relate to an annual percentage growth rate of 3.5 percent and would correlate to a 9.44 percent-age share of Maricopa County based registered aircraft. If registered based aircraft forecasts for Maricopa County occur as projected and population growth of the Glendale MPA occurs as projected, it is very likely that the market share of registered aircraft will increase over the planning period. An increasing share reaching 9.6 percent by 2020 would yield 390 based aircraft.

A market share analysis of regional and national aircraft totals was also conducted. **Table 2C** depicts historical and forecast aircraft for FAA's Western Pacific Region and U. S. Active aircraft. The table also presents a market share analysis of Glendale Municipal Airport's historical share of these figures. As indicated by the table, Glendale Municipal Airport's based aircraft market share for both U.S. and Western Pacific Region active aircraft increased between 1986 and 1996. Two market share forecasts are presented in **Table 2C**.

TABLE 2C
Aircraft Market Share Analysis
Glendale Municipal Airport

Year	Glendale Airport Based Aircraft	U. S. Active Aircraft	% of U. S. Active	Western PAC	% of Western PAC	
1986	205	196,500	0.104%	34,300	0.59%	
1987	209	205,300	0.101%	36,100	0.57%	
1988	197	202,700	0.097%	35,300	0.55%	
1989	167	196,200	0.085%	34,200	0.48%	
1990	202	205,000	0.098%	35,100	0.57%	
1991	167	198,000	0.084%	34,700	0.48%	
1992	160	198,500	0.081%	36,500	0.43%	
1993	143	184,400	0.077%	31,400	0.45%	
1994	178	176,000	0.101%	29,600	0.60%	
1995	184	170,600	0.107%	28,200	0.65%	
1996	188	167,300 (est)	0.112%	27,700 (est)	0.68%	
FORECASTS						
Year	Based Aircraft	U.S. Active	%	Western PAC	%	Based Aircraft
Constant Share						
2000	190	170,000	0.112%	28,200	0.68%	192
2005	198	176,800	0.112%	28,800	0.68%	196
2010	204	182,200	0.112%	29,500	0.68%	201
2015	210	187,700	0.112%	30,100	0.68%	205
2020	217	194,140	0.112%	30,880	0.68%	210
Increasing Share						
2000	221	170,000	0.13%	28,200	0.80%	225
2005	265	176,800	0.15%	28,800	0.90%	260
2010	310	182,200	0.17%	29,500	1.00%	295
2015	357	187,700	0.19%	30,100	1.10%	331
2020	408	194,140	0.21%	30,880	1.20%	371

First, a constant, or static market share of based aircraft was applied to U.S. and Western Pacific Region active aircraft forecasts. Maintaining a constant market share of U.S. active aircraft, Glendale Municipal Airport can expect 217 based aircraft by 2020. A constant share of Western Pacific aircraft would yield 210 aircraft by 2020. Based upon the past history and

the growth potential of the Glendale MPA, it is likely that the market share of aircraft based at the airport will increase. According to the table, an increasing market share of U.S. active and Western Pacific aircraft yields 408 and 371 based aircraft respectively.

The last forecast method employed was an analysis of aircraft per 1,000

household residents and 1,000 persons employed in the Glendale MPA. Typically, as the population and employment of an area increases, aircraft per 1,000 residents decreases. **Table 2D** summarizes historical and

forecast aircraft per 1,000 household residents and aircraft per 1,000 persons employed in the Glendale MPA assuming a decreasing ratio of aircraft to 1,000 household residents and persons employed.

TABLE 2D Aircraft Per 1,000 Residents in Households and 1,000 Persons Employed Glendale Municipal Airport					
Year	Based Aircraft	Glendale MPA Residents	Aircraft per 1,000 MPA Residents	Glendale MPA Total Employment	Aircraft per 1,000 Persons Employed
1990	202	159,068	1.26	50,430	4.0
1995	184	188,610	0.98	62,802	2.92
<i>Forecasts</i>					
Year	Based Aircraft	Glendale MPA Residents		Aircraft per 1,000 MPA Residents	
2000	210	214,405		0.98	
2005	228	235,212		0.97	
2010	249	258,973		0.96	
2015	270	284,579		0.95	
2020	295	314,303		0.94	
Year	Based Aircraft	Glendale MPA Total Employment		Aircraft per 1,000 Persons Employed	
2000	223	76,292		2.92	
2005	254	87,464		2.90	
2010	285	98,752		2.89	
2015	308	106,973		2.88	
2020	330	115,088		2.86	

Presented in **Table 2E**, and on **Exhibit 2B** is a summary of all forecasts for based aircraft at Glendale Municipal Airport. In all likelihood, actual activity will not follow any one of the projections exactly. It is more likely that based aircraft levels will fluctuate within the range of the projections depicted on **Exhibit 2B**. Thus, these lines serve more as a planning envelope. The planning envelope reflects a reasonable

range for based aircraft at the airport. With this in mind, the time-based projections of anticipated growth should serve only as a guide. At any given time over the planning period, the actual level of based aircraft could fall within the envelope area defined by low range (Aircraft per 1,000 Household Residents) or the high range (Increasing Market Share of U.S. Active Aircraft).

The 1996 FAA Terminal Area Forecasts (TAF) and 1989 Master Plan based aircraft projections for the airport have been included for comparative purposes. The 1996 FAA TAF uses 1995 base year data and forecasts based aircraft

growing at an average annual rate of 1.5 percent through the year 2010. The 1989 Master Plan used 1987 base year data and projected based aircraft growing at an average annual rate of 4.5 percent through the year 2010.

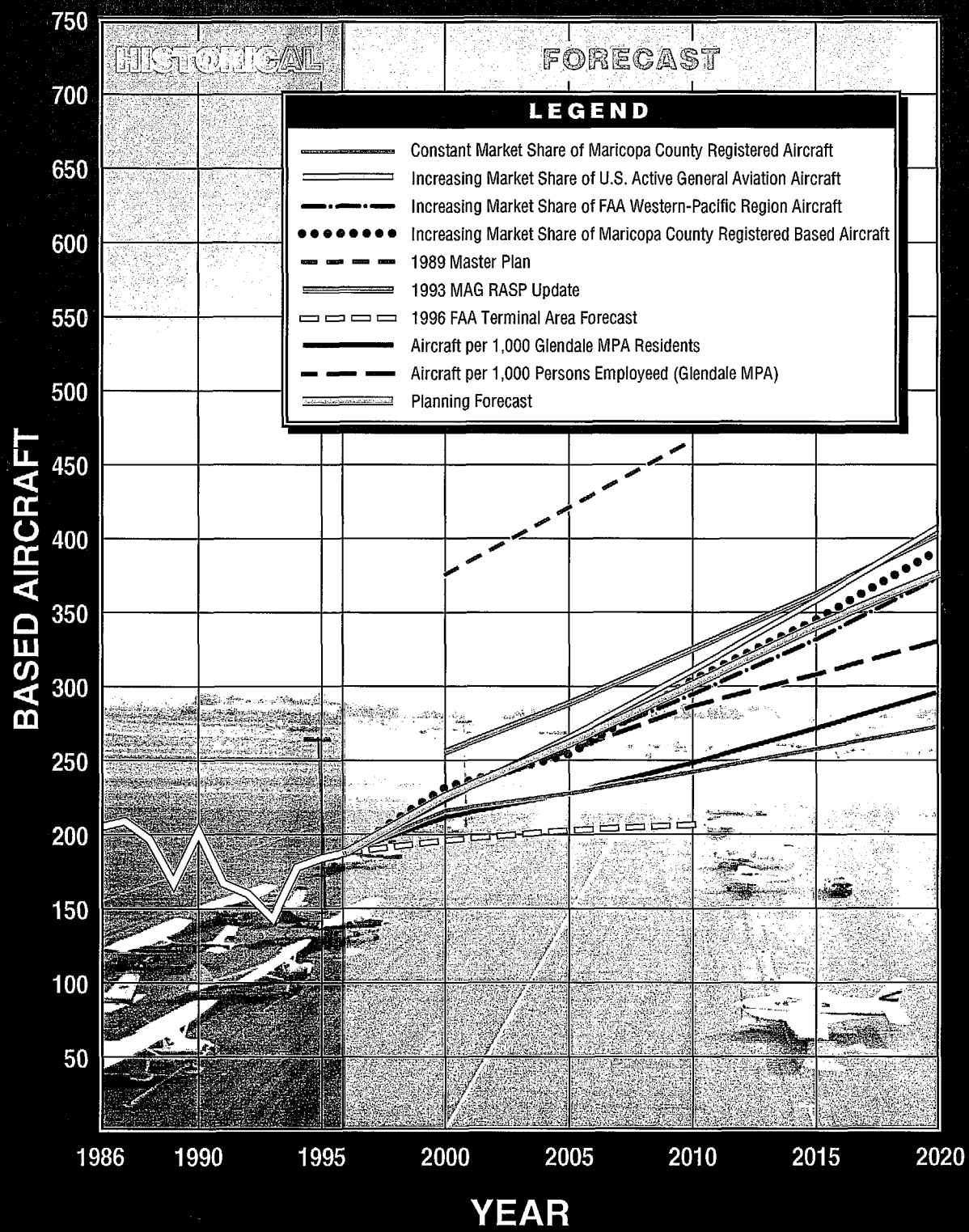
TABLE 2E

**Based Aircraft Forecast Summary
Glendale Municipal Airport**

	2000	2005	2010	2015	2020
Constant Market Share of					
U.S. Active General Aviation Aircraft	190	198	204	210	217
FAA Western-Pacific Region Aircraft	192	196	201	205	210
Maricopa County Registered Based Aircraft	216	228	242	257	272
Increasing Market Share of					
U.S. Active General Aviation Aircraft	221	265	310	357	408
FAA Western-Pacific Region Aircraft	225	260	295	331	371
Maricopa County Registered Based Aircraft	230	252	304	345	390
Other Forecasts					
1993 MAG RASP Update	256	288	325	362	403
1996 FAA Terminal Area Forecast	198	203	208	N/A	N/A
1989 Master Plan	375	420	466	N/A	N/A
Aircraft per 1,000 Glendale MPA Residents	210	228	249	270	295
Aircraft per 1,000 Persons Employed (Glendale MPA)	223	254	285	308	330
Planning Forecast	225	260	300	340	375

A number of improvement projects completed in 1997 support increased based aircraft growth at the airport and the airport capturing a greater share of the local and regional aviation markets. For example, the City of Glendale constructed taxiways and extended utilities to the area north of Glendale Aviation for the development of private aircraft storage hangars. As planned, this area can accommodate between 175 and 200 hangar units (depending on the size of hangars). A second area for hangar development was developed at

the south end of the existing shade and T-hangar area. This area is currently planned for 12 hangar units. Hangars in this area are being developed by Temple Air, a charter operator based at the airport. Both areas have the potential of attracting additional aircraft within the next five years. Action Aviation leases a 30,000 square foot parcel for the development of multiple and single-unit aircraft storage hangars along Glen Harbor Boulevard, north of the terminal.



A review of existing hangar space indicates that only 115 of the 219 available shade and T-hangars are filled. Uncompetitive rental rates are believed to have contributed to the availability of shade and T-hangar space at the airport. Should more competitive market rates be established for the hangars, the potential exists for a higher occupancy rate in these hangars and additional based aircraft for the airport.

Fleet Mix

Knowing the aircraft fleet mix expected to utilize the airport is necessary to properly plan facilities that will best serve the level of activity and type of activities occurring at the airport. The existing based aircraft fleet mix is comprised primarily of single-engine piston aircraft, but also includes multi-engine piston and turboprop aircraft, as well as helicopters. Additionally, other aircraft such as ultralights, balloons, and gliders are based at the airport.

The airport's December 1996 based aircraft fleet mix consisted of a higher percentage of single-engine piston aircraft and a lower percentage of multi-engine piston, turboprop, and helicopter aircraft than found in the national fleet. While single-engine piston aircraft account for roughly 72 percent of the national fleet, they comprise 95 percent of the total based aircraft at the airport. Nationally, multi-engine piston aircraft comprise 9 percent of the active fleet, while locally they account for 2 percent of total based aircraft. Nationally, turboprop aircraft account for 2.5 percent of the active fleet, while at the

airport they currently account for less than one percent of total based aircraft. Helicopter aircraft account for 2.6 percent of the national fleet, at the airport, helicopter aircraft comprise one percent of total based aircraft.

The forecast mix of based aircraft was determined by comparing existing and forecast U.S. general aviation fleet trends to the 1996 based aircraft fleet mix. The *FAA Aviation Forecasts Fiscal Years 1996-2007* was consulted for the U.S. general aviation fleet mix trends and considered in the fleet mix projections. The trend in general aviation is toward a greater percentage of larger, more sophisticated turboprop, jet and helicopters, and a reduction in the number of single-engine piston aircraft. The number of multi-engine piston aircraft essentially remains static through the planning period after declining slightly in the early portion of the planning period.

The fleet composition of based aircraft is expected to remain heavily in single-engine piston aircraft, although there is expected to be an increasing percentage of turboprop, jet, and helicopters in the future mix, consistent with national trends. **Table 2F** and **Exhibit 2C** summarize the based aircraft fleet mix projections for the airport.

ANNUAL OPERATIONS

The air traffic control tower (ATCT) located on the airport collects information regarding aircraft operations (takeoffs and landings). Aircraft operations at the airport are categorized as either local or itinerant

by the ATCT. Local operations consist mostly of aircraft training operations conducted within the aircraft traffic pattern and touch-and-go operations.

Itinerant operations are originating or departing aircraft which are not conducting operations within the airport traffic pattern.

TABLE 2F
Projected Based Aircraft Fleet Mix
Glendale Municipal Airport

Year	Total Based Aircraft	Single Engine	Multi Engine	Turbo Prop	Jet	Helicopter	Other
<i>Historical</i>							
1996	188	179	4	1	0	2	2
<i>Forecast</i>							
2000	225	210	7	2	1	3	2
2005	260	236	13	3	2	4	2
2010	300	263	21	5	3	6	2
2015	340	292	27	7	4	8	2
2020	375	315	34	9	5	10	2

¹ Glider, Ultralight, Balloon

Source for Historical Data: Arizona Department of Transportation, Aeronautics Division

For purposes of this forecasting effort, military operations are included within the general aviation forecasts due to their small number. Military operations at the airport have historically fluctuated, with the largest annual total of nearly 700 occurring in 1987. In 1986, 1993, and 1994 there were no recorded military operations at the airport.

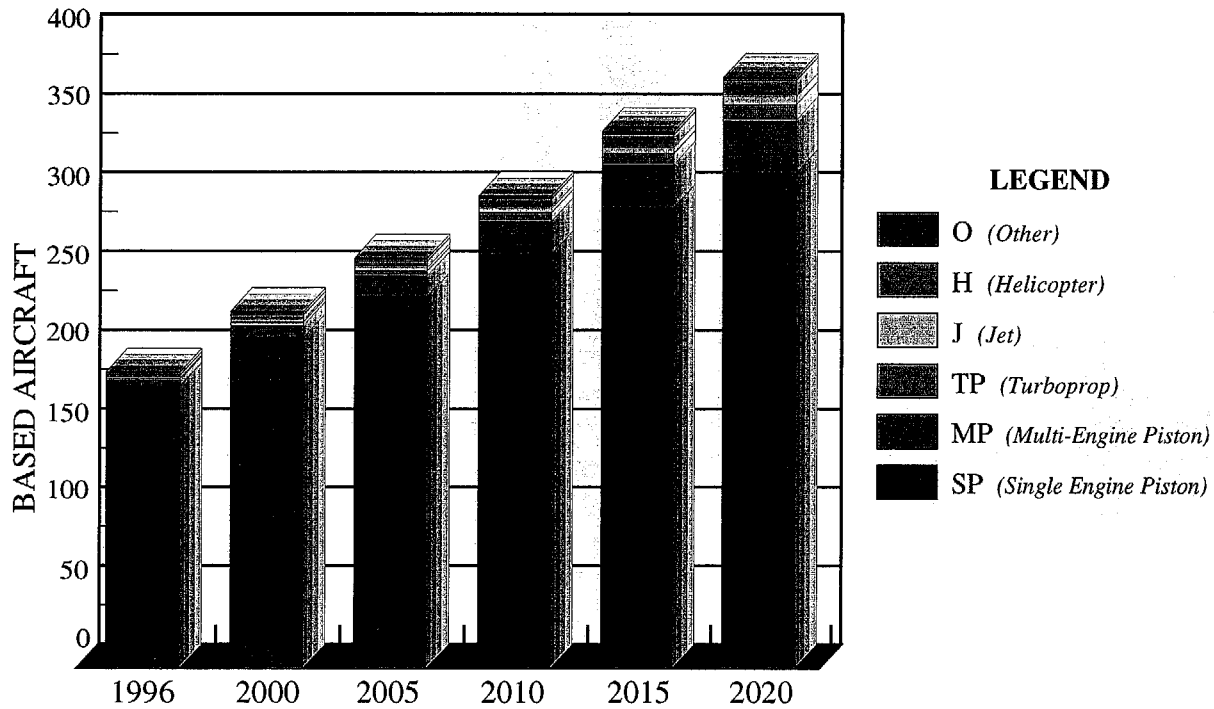
Since 1990, operations have declined at the airport. The majority of this decline can be attributed to the decline in local operations. In 1990, there were 108,000 local operations; in 1996, local operations totaled 78,000. Much of the decline in local operations can be attributed to ATC, a large airline training organization, suspending operations in the early 1990's. Itinerant

operations declined only slightly since 1990, from 42,000 to 39,000.

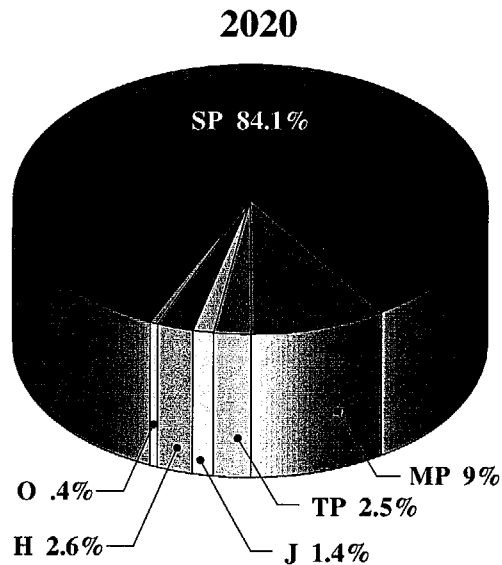
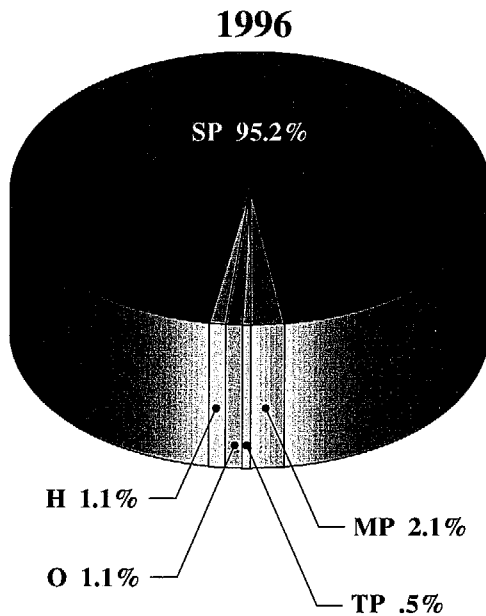
Similar to based aircraft, the overall decline in annual operations and yearly fluctuations did not provide reasonable correlations for use in regression and trend line analyses. Therefore, projections of annual operations at Glendale Municipal Airport were prepared by examining the number of operations per based aircraft and applying an average annual growth rate to existing operational levels.

Typically, operations per based aircraft can range between 300 and 800 at airports similar to Glendale Municipal Airport. Airport's with high training, or local operations will have a higher operation per based aircraft ratio,

BASED AIRCRAFT



PERCENT BY AIRCRAFT TYPE



whereas, airport's utilized by a higher percentage of transient aircraft will have lower ratios. For example, Mesa-Falcon Field and Phoenix Deer Valley Airports historically have averaged between 300 and 400 operations per based aircraft. These airports experience a high percentage of local operations, however, they have more than twice as many based aircraft and only 50,000 additional operations.

Table 2G presents historical annual operational totals and operations per

based aircraft for the airport. As evidenced in the table, operations per based aircraft have declined since 1990, similar to the decline experienced in local operations. The decline in operations per based aircraft should slow as local operations at the airport stabilize and based aircraft numbers grow. For forecasting purposes, a constant, or static level of 630 operations per based aircraft was applied to based aircraft planning forecast. This results in an operational level of 236,300 in 2020.

TABLE 2G Historical Annual Operations and Operations Per Based Aircraft Glendale Municipal Airport			
Year	Based Aircraft	Annual Operations	Operations Per Based Aircraft
1986	205	33,855	165
1987	209	73,685	353
1988	197	93,067	472
1989	167	145,300	870
1990	202	151,662	751
1991	167	136,672	818
1992	160	112,837	705
1993	143	113,889	796
1994	178	115,068	646
1995	184	127,323	692
1996	188	118,387	630

Another technique utilized for projecting future operational levels is forecasting according to an average annual growth rate. According to *FAA Aviation Forecasts-Fiscal Years 1996-2007*, the FAA projects that total general aviation operations at contract towered airports will increase on an average annual basis of 2.12 percent. Projecting total annual operations at the airport using the FAA projection of a 2.12 percent annual growth rate yields 195,900 operations in 2020.

It would be reasonable to assume that operations at the airport will grow at a rate higher than the national average as based aircraft are projected to increase at a rate higher than the national average (2.9 percent annually). The airport can expect to increase on an average annual basis of between two and three percent as population and employment in the Glendale MPA increase and aircraft operators move away from other busy area airports. Applying a 2.5 percent average annual

growth rate yields approximately 214,100 operations by 2020.

Also considered was the forecasted operational levels for Glendale Municipal Airport presented in the *1993 MAG RASP Study*, *1996 FAA TAF*, and *1989 Master Plan*. The MAG study indicated that operations would reach 253,300 by 2015 equating to an average annual growth rate of 2.1 percent. The 1996 FAA TAF projects operations growing at an annual rate of 1.9 percent. The 1989 Master Plan projected operations growing to 256,300 by 2010 (an average annual rate of 5.6 percent).

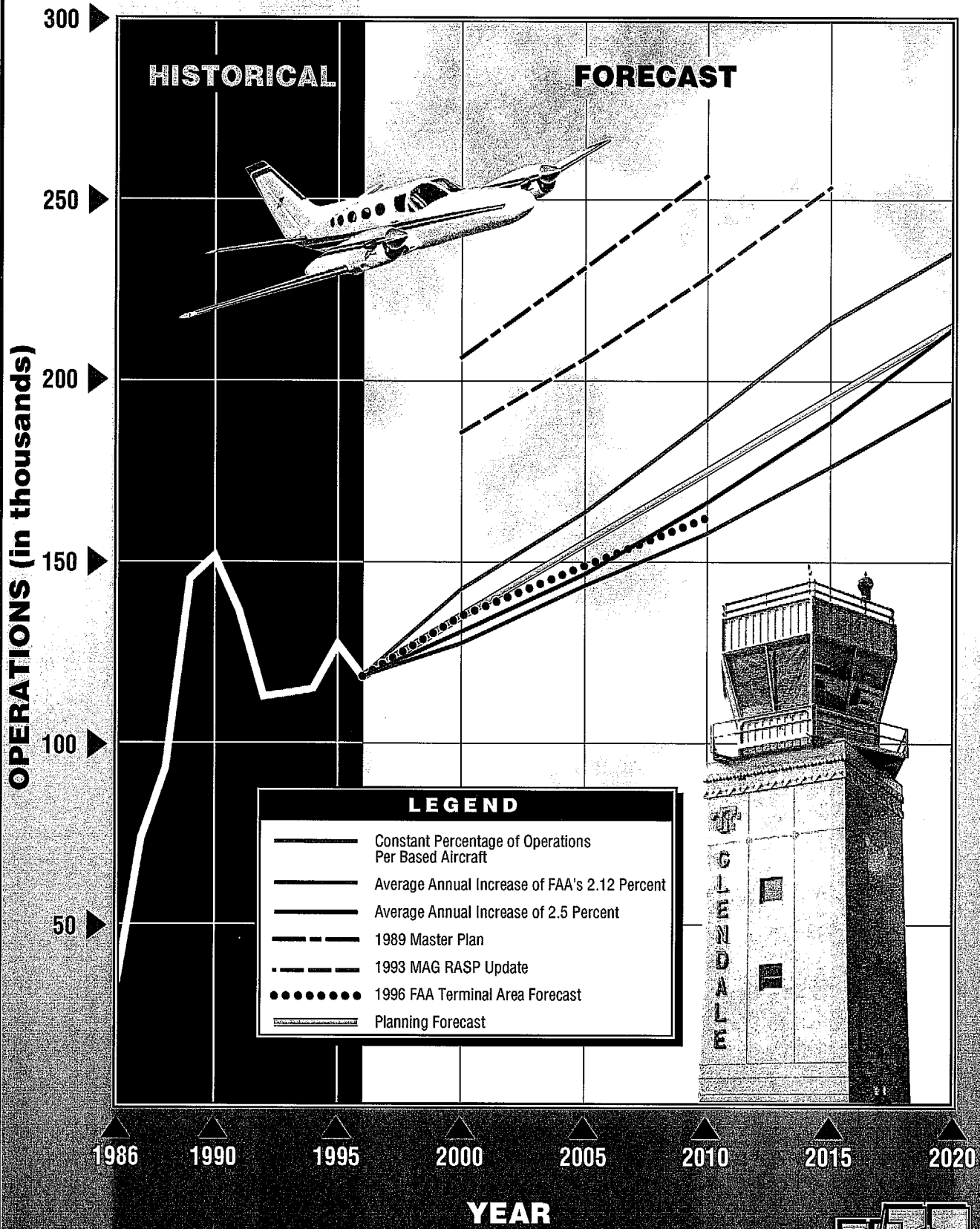
Glendale Municipal Airport. The combination of the "FAA Average Annual Increase of 2.12 Percent" forecast and "Constant Percentage of Operations per Based Aircraft" forecast define the high side and low side of the "forecast envelope". While the planning forecast does not project annual operations to grow at the same rate as based aircraft, annual operations are projected to exceed regional and national growth due to projected strong based aircraft growth. The planning forecast represents this expected growth. Total annual operations are projected to grow at an average annual rate of 2.5 percent.

Exhibit 2D and **Table 2H** summarize the operations forecasts developed for

TABLE 2H Annual Operations Forecasts Glendale Municipal Airport					
	2000	2005	2010	2015	2020
Constant Percentage of Operations Per Based Aircraft	141,800	163,800	189,000	214,200	236,300
Average Annual Increase of:					
FAA's 2.12 Percent	128,800	143,000	158,800	176,400	195,900
2.5 Percent	130,700	147,900	167,300	189,300	214,100
<i>1993 MAG RASP</i>	185,800	206,200	228,700	253,300	N/A
<i>1996 FAA Terminal Area Forecast</i>	135,093	148,945	162,295	N/A	N/A
<i>1989 Master Plan</i>	206,300	231,000	256,300	N/A	N/A
<i>Planning Forecast</i>	135,000	155,000	175,000	195,000	215,000

Historically, local operations have accounted for a larger portion of annual operations than itinerant operations. This is representative of the high levels of aircraft training activity in the region. Itinerant operations are forecast to increase through the planning period (in number and as a

percentage of total annual operations) due to the expected increased utilization of business and corporate aircraft at the airport (which are typically itinerant operations). The projection of local and itinerant operations are summarized in the table at the end of this chapter.



PEAKING CHARACTERISTICS

Many airport facility needs are related to the levels of activity during peak periods. The periods used in developing facility requirements for this study are as follows:

- **Peak Month** - The calendar month when peak aircraft operations occur.
- **Design Day** - The average day in the peak month. This indicator is easily derived by dividing the peak month operations by the number of days in a month.
- **Busy Day** - The busy day of a typical week in the peak month. This descriptor is used primarily to determine apron space requirements.
- **Design Hour** - The peak hour within the design day. This descriptor is used in airfield capacity analysis and as the basis in determining terminal building requirements.

It is important to note that only the peak month is an absolute peak within a given year. All other peak periods will be exceeded at various times during the year. However, they do represent reasonable planning standards that can be applied without overbuilding or being too restrictive.

Peaking characteristics for Glendale Municipal Airport have been determined by examining operational characteristics at the airport and considering trends experienced at similar airports across the country. Typically, the peak month for general aviation operations approximates 10-12 percent of the airport's annual operations. The peak month for recorded operations in 1996 was March, with 11 percent of the annual total. This factor has been applied to forecast annual operations to determine peak month operations forecasts for the airport. The forecast of busy day operations at the airport was calculated as 1.25 times design day activity. Design hour operations were calculated as 13.0 percent of design day operations. **Table 2J** summarizes peak activity forecasts for the airport.

TABLE 2J
Peak Period Forecasts
Glendale Municipal Airport

	1996	2000	2005	2010	2015	2020
Annual Operations	118,387	135,000	155,000	175,000	195,000	215,000
Peak Month	13,023	14,850	17,050	19,250	21,450	23,650
Design Day	434	495	568	642	715	788
Busy Day	543	619	710	802	894	985
Design Hour	56	64	74	83	93	102

FORECAST SUMMARY

This chapter has outlined the various aviation demand levels anticipated over the planning period. Historically, aviation activity at the airport has not followed the national trends. While the based aircraft totals at the airport declined in the early 1990's similar to national trends, based aircraft totals have since recovered while nationally total active aircraft continue to decline. Long-term growth will be sustained by the growing local economy and popu-

lation. Overall, aviation activity at the airport is forecast to exceed regional and national growth rates.

The next step in the master plan is to assess the capacity of existing facilities to accommodate forecast demand and determine which facilities will need to be improved to meet these demands. This will be examined in the next chapter -- Chapter 3, Facility Needs Evaluation. **Table 2K** presents a summary of the aviation forecasts developed for the airport.

TABLE 2K
Aviation Forecast Summary
Glendale Municipal Airport

	1996	2000	2005	2010	2015	2020
Annual Operations						
Itinerant Operations	39,936	45,900	54,300	66,500	78,000	96,800
Local Operations	<u>78,451</u>	<u>89,100</u>	<u>100,700</u>	<u>108,500</u>	<u>117,000</u>	<u>118,200</u>
Total Annual Operations ¹	118,387	135,000	155,000	175,000	195,000	215,000
Based Aircraft	188	225	260	300	340	375

¹ Includes Military Operations